

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 10/774,964
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Applicant: Trabold et al.
Group Art Unit: 1795
Examiner: Edu Enin-Okut
Title: FUEL CELL FLOODING DETECTION
Attorney Docket: 8540G-000148 (GP-302644)

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

DECLARATION OF STEVEN R. FALTA UNDER 37 C.F.R. §1.132

Sir:

I hereby declare under penalty of perjury as follows:

1. That I am a co-inventor of the above-identified application.
2. The present application uses fluctuations in the signal from a pressure sensing device as a means of identifying flooding in a fuel cell stack. This concept is unique for several reasons and provides unexpected and long-needed benefits including increased speed and sensitivity for flooding detection.
3. The present application provides improved sensitivity of at least 10-fold as compared to known methods. In U.S. Patent No. 6,103,409, fuel cell stack flooding is determined by the magnitude of the mean pressure drop. However, as shown in Figure 4 of 6,103,409 (below), the mean pressure drop indication, upon which the flooding detection and

correction are based, attains a reasonably steady-state condition after an elapsed time of 1000 seconds or more.

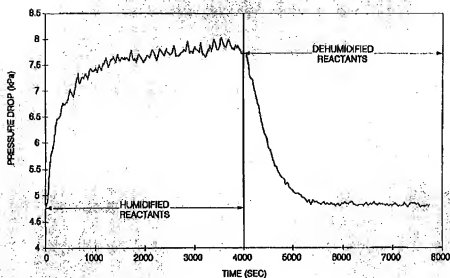


FIG. 4

3. The present application offers an improvement because the level of pressure drop fluctuations can be determined much more rapidly, on the order of 100 seconds or less, with appropriate ΔP instrumentation sampling at 10 Hz or greater. Thus, the present application is much more amenable to automotive fuel cell operation, wherein dynamic load following operation rarely allows for greater than several minutes at a fixed load condition.

4. Also, the present application beneficially eliminates the need for a comparison to be made between the pressure drop measured on the anode and cathode during fuel cell operation, and the pressure drops measured in the unflooded "reference" stack. The present application reduces and/or eliminates the arduous task measuring *a priori* all anode and cathode pressure drops at every combination of flow and electrical load condition expected to be encountered during fuel cell operation.

5. The present application is a significant improvement in that no such prior knowledge of unflooded stack pressure drop is required, because the detection method considers only fluctuations about the mean pressure drop reading. This streamlines set-up and operation of the fuel cell in addition to improving the response to flooding.

6. As such, the present application removes reliance on the actual magnitude of the mean pressure drop, and how it relates to the "dry" state. This reduces preparation required for flooding detection and streamlines integration into multiple fuel cell systems across different platforms.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are being made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, and patent issuing thereon, or any patent to which this verified statement is directed.

Dated: 18 MAR 1980

Steven R Falta
Steven R. Falta
Address: 445 Cheese Factory Rd.
Honeoye Falls, NY 14472

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